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RADIUM

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VOL. XII

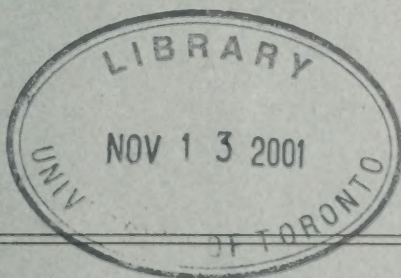
OCTOBER, 1918

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AND RADIO-ACTIVE SUBSTANCES

RADIUM

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THERAPEUTICS OF RADIUM AND RADIO-ACTIVE SUBSTANCES

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No. 1

NEW GROWTHS OF THE MEDIASTINUM.

WITH SPECIAL REFERENCE TO THEIR TREATMENT WITH RADIUM*

CURTIS F. BURNAM, M. D.

BALTIMORE

While the sole purpose of this paper is to show through the detailed report of individual cases that radium may be used as an effectual remedy for many primary mediastinal new growths, an incurable habit of introduction seems to make indispensable a few preliminary statements dealing broadly with the clinical and pathologic aspects of the diseases under consideration.

Malignant new growths are much commoner than benign in the mediastinum. Metastatic lymphosarcoma, Hodgkin's disease, carcinoma and sarcoma are very frequent, while primary mediastinal malignancy is rare. In these secondary cases, however, the primary lesion almost invariably dominates the clinical picture, from the standpoints both of diagnosis and of treatment.

A roentgenographic examination of the chest should be made before the treatment, operative or otherwise, of any malignant growth is undertaken, particularly in cases of tumors of the thyroid, ovary, breast and testicle. The very interesting data which we have accumulated as to the effects of radium on these secondary mediastinal tumors will be considered not in this paper, but in subsequent reports dealing with the classes of neoplasms to which they belong. The primary tumors of the chest wall, of the pleura, of the esophagus and of the lungs will also be excluded from this paper, but reported in separate communications to appear later.

*Reprinted from the Journal of the American Medical Association LXIX, 989-996, September 22, 1917. Read before the Section on Pharmacology and Therapeutics at the Sixty-Eighth Annual Session of the American Medical Association, New York, June, 1917.

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So far as I have been able to ascertain, there has never been a surgical cure of a malignant mediastinal tumor. A number of operations have been done to relieve acute pressure symptoms, and an excellent statement of this kind of work has been made by Friedrich.⁶ Several cases of great improvement or cure through Roentgen-ray treatments are on record.

Not much detail is at hand in regard to any of these patients, and in only one was a histologic diagnosis available.

In addition to the conditions described, it should be remembered that large mediastinal masses due to tuberculosis and syphilis are occasionally observed. Martini (12) in a series of fourteen mediastinal tumors describes three syphilitic tumors, two tuberculous tumors, three lymphosarcomas, two sarcomas other than lymphosarcoma, one carcinoma, one hypertrophied thymus, one retrosternal thyroid, and one undiagnosed tumor.

Of the various kinds of tumors which occur in the chest, perhaps the most frequent is aortic aneurysm. In every differential diagnosis of mediastinal tumor, aortic aneurysm must be ruled out, which can usually be done from the clinical history and physical examinations.

Great reliance is placed on the fluoroscopic demonstration of expansile pulsation. It is of interest to note that in Case 5 of the series herein reported, an apparent expansile pulsation led to an incorrect diagnosis of aneurysm. Quite recently we made a positive diagnosis of solid tumor in a patient in whom no pulsation was visible, but changed our decision when the necropsy revealed an immense aneurysm, which had ruptured at one point.

SYMPTOMS

The initial subjective disturbances of mediastinal tumor are quite variable. Slight discomfort in the chest on exertion and a cough are the most common; sometimes there is hoarseness due to vocal cord paralysis, as in Case 4; occasionally difficulty in swallowing nausea and abdominal pain, as in Case 7, or spastic paralysis of the lower extremities, as in Case 2. One quite recent case of mediastinal Hodgkin's disease was treated for months by skin specialists for pruritus before the true nature of the disease came to light.

In the later stages dyspnea, cyanosis, dilation of the veins of the face and the chest, and disturbance of the heart and aorta, severe pain and inanition may arise. Fluid in the pleural and pericardial cavities is quite common. The benign growths may give only mild disturbance for many years but the malignant tumors usually advance rapidly. Death is more frequently from asphyxia.

DIAGNOSIS

The recognition of a mediastinal tumor rests on: (1) ordinary physical examination of the chest; (2) roentgenographic and fluoroscopic examinations, and (3) direct examinations of the larynx, trachea and esophagus in patients in whom pressure symptoms on either the trachea or esophagus have developed.

The differentiation of the primary from the secondary tumors is made by an exhaustive general physical examination to exclude carcinoma or sarcoma elsewhere than in the chest. The general examination, plus

6. Friedrich, P. L.: Beitr. z. klin. Chir., **93**, 312.

12. Martini, Piazza: Ann. d. Clin. Med., 1914, **5**, Nos. 2 and 3.

the history and the Wassermann and tuberculin tests, may differentiate mediastinal tumor from tuberculosis, syphilis or ordinary abscess. A history of pruritus and a blood picture, such as Bunting describes as typical for Hodgkin's disease, is very suggestive of that disease. It would seem, however, that the blood picture alone can never be conclusive when the tumor is limited to the mediastinum.

If the tumor has grown up through the thorax into the neck, or lies directly against the chest wall, or has metastasized to a superficial gland, an operation and removal of tissue for histologic study is indicated, and will usually allow a positive classification of the neoplasm.

TREATMENT

In view of our experiences, I believe that as soon as a diagnosis is made, treatment with radium should be instituted promptly and, when this is not available, the Roentgen-ray should be tried. In the series of eight cases reported in this paper, two patients (Cases 4 and 8) had had Roentgen-ray treatments without benefit before the radium was started.

Considerable amounts of radium (a gram or more, if possible) are necessary properly to carry out the treatments. In order to secure penetration into the depths and to avoid injury of the skin, leads filters to absorb all but the penetrating gamma rays should be used, and a fixed distance from the skin established. In none of the reported cases was the slightest irritation of the skin produced by the treatments. The exact technic employed in each case is given with the case record. As will be seen, the treatments have been variable, depending in part on the response of the patient and in part on the radium available for use.

RESULTS

After a preliminary nausea for a day or two following the treatment (this condition was present in only half of the cases), the subjective symptoms were usually greatly relieved.

1. With the exception of the first, in each of the eight cases the patients have continuously improved (Figs. 1 and 2).

2. One patient has now been under observation for three years (Fig. 3). As a result of the treatment, the paralysis is entirely relieved, and there is no evidence of the presence of the disease except as shown by the roentgenogram (Fig. 4.)

3. In one patient the lymphosarcoma has been gone for four years after treatment was started (Figs. 5, 6 and 7).

4. Vocal cord paralysis has cleared up in another patient, and evidences of the mediastinal tumor have been absent for more than a year (Figs. 8 and 9).

5. In a fifth case (Figs. 10 and 11), although treatment thus far given has been insufficient, the patient is free from all subjective disturbances and the growth has become markedly reduced in size eighteen months after the treatment was instituted.

6. One year after treatment was begun, the roentgenogram in a case of mixed-cell sarcoma (Figs. 12, 13 and 14) show but little sign of the tumor, and the patient has symptomatically recovered.

7. A desperately ill patient with a granuloma, probably Hodgkin's disease, is apparently in perfect health one year after treatment was started (Figs. 15, 16 and 17).

8. Thirty months after the beginning of treatment, a patient who

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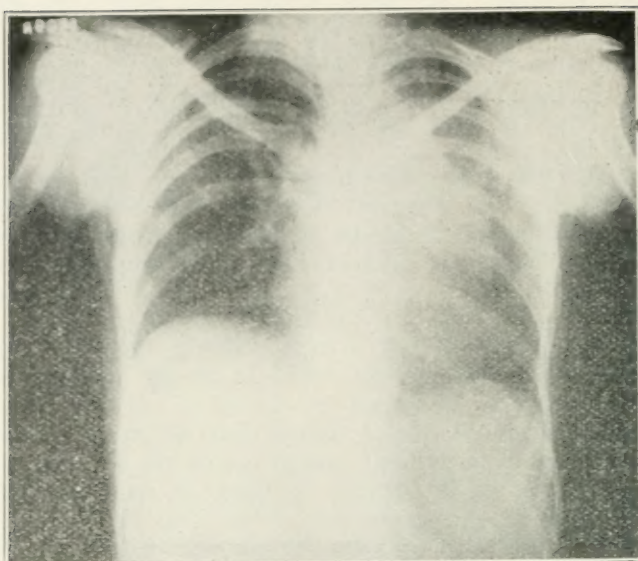


Fig. 5 (Case 3).—Large lymphosarcoma which bulged above the clavicle exterior, June 4, 1913.

had a mediastinal tumor with hydrothorax is now apparently fully recovered (Figs. 18 and 19).

In addition to these eight cases, it should be stated that two patients with tumor of unknown type improved greatly, but have withdrawn from treatment; one patient with sarcoma improved greatly until a burn precluded treatment, and the tumor has since grown much worse; one small growth of unknown character has been uninfluenced by treatment, and has remained stationary for more than a year; and one spindle-cell sarcoma of the heart was not benefited.

REPORT OF CASES

CASE I (872).—Malignant mediastinal tumor, probably of thymus origin. Marked improvement of symptoms as a result of treatment. Final death of patient.

History.—R. W., girl, aged 4, was admitted to the hospital, June 2, 1914, with a severe cough and great difficulty in respiration.

Examination.—The patient was well nourished and well developed, with good color. She was suffering with a severe cough and a tendency, on the slightest movement, to great shortness of breath and severe dyspnea. The condition was rapidly growing worse. A roentgenogram of the chest disclosed a definite mass behind the manubrium.

Treatment.—On the morning of June 2, 1914, 1911 mg. of radium, screened with 3 mm. of lead and 1½ inches of gauze were applied over the sternum for one and one-quarter hours. There was no nausea or general discomfort following this treatment, and the next morning the patient was breathing comfortably. Within four or five days after the treatment, the child had apparently returned to normal health. At the time we believed that we were probably dealing with a simple hypertrophy of the thymus gland.

The patient remained comfortable and in good health until the

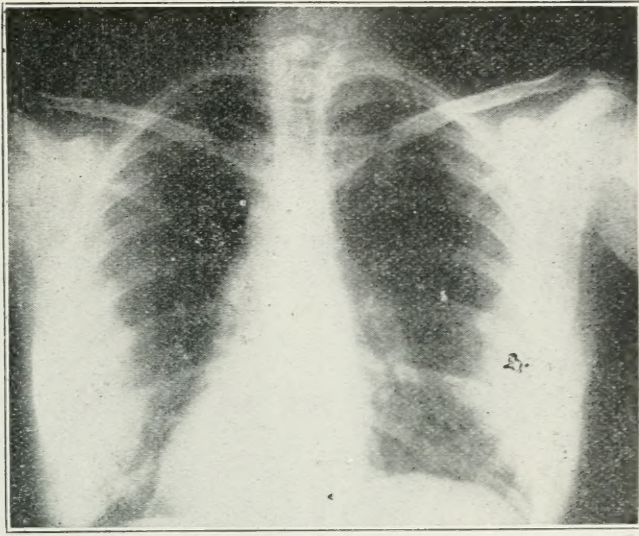


Fig. 7 (Case 3).—Tumor, April, 1917, practically cleared up under radium therapy.

latter part of July, when she apparently took cold. Then the cough and difficulty in breathing returned, but in a milder form. July 30, the patient received a second treatment, identical with that given June 2. Again there was a subsidence of symptoms, but the parents were instructed to bring the child in for further treatment. August 12, treatment with 1,911 mg. of radium, filtered by 3 mm. of lead and $2\frac{1}{2}$ inches of gauze, was given for three and three-quarter hours on the upper chest, particularly over the front and from behind. August 18, the patient was again treated with 1,911 mg. of radium, filtered by 3 mm. of lead and $2\frac{1}{2}$ inches of gauze, for four hours. Roentgenograms and other examinations at this time revealed no evidence whatever of disease.

The patient had no further respiratory trouble, but early in January she began to suffer with nausea and vomiting, and a large abdominal mass appeared. She died the latter part of January, 1915, from general weakness.

CASE 2 (1010).—An extensive sarcoma of the posterior mediastinum leading to paralysis of the legs and difficulty with the vesical and rectal sphincters. Entire relief of symptoms, although the roentgenogram still shows a shadow three years after the first treatment.

History.—Miss M. V. J., aged 19, complained of pain in the back and legs, and of paralysis of the legs. She was admitted to the hospital, Feb. 13, 1914. No history of malignant tumors in the family was given and the patient had always been healthy, with the exception of pneumonia at the age of 14, until the present trouble developed. Her present illness began in December, 1912, with a dull aching pain in the back, which was worse when she was on her feet. There was increased frequency of voiding and a numb feeling below the waist. Her gait became unsteady, and finally she was unable to move her legs or even her toes.

Examination.—She was well nourished, had excellent color and did not seem ill except for the paralysis.

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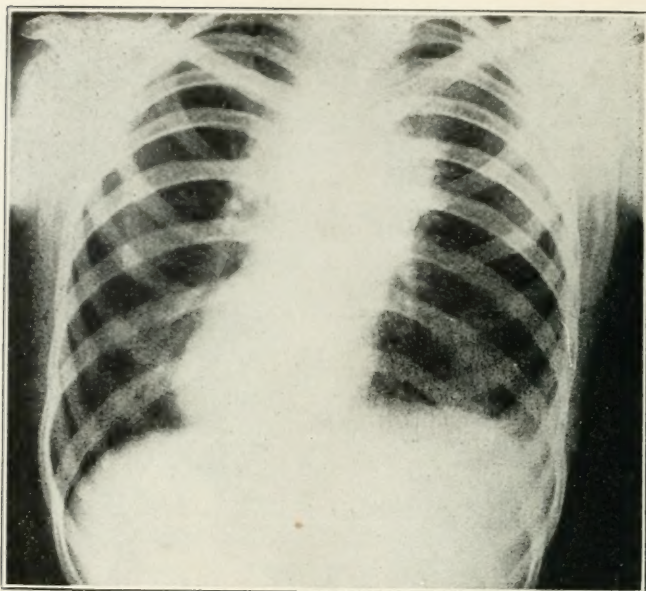


Fig. 8 (Case 4).—Extensive tumor of the mediastinum, April 27, 1916, which extends out into the lung tissue.

Between the date of her admission to the hospital and March 25, the patient grew steadily worse so far as the paralysis was concerned. A diagnosis of chest tumor was made, and an exploratory operation was done, March 25, by Dr. J. M. T. Finney, through the left side of the back, and a large, extremely vascular tumor was found, from which a piece was removed. Unfortunately, this specimen was lost, so that a diagnosis as to the exact nature of this growth is not obtainable. Following this operation, the patient was a little better for two weeks, but she again became worse.

Treatment.—The patient was given radiation, May 21, 1914, with 1,583 mg. of radium through 3mm. of lead and 1 inch of gauze on each of 12 areas, on the back and left chest, one hour over each area. She was very much nauseated and upset by this treatment for several days. However, the condition began to improve, and within three weeks she could move her feet and legs in bed and was beginning to be able to stand. July 27, 1914, a second treatment of twelve and one-half hours was given with 1,911 mg. of radium, screened by 3mm. of lead and 6 inches of gauze, over the site of the tumor through the back. Dec. 20, 1914, the patient was again treated with 1,911 mg. of radium, screened by 3mm. of lead and 4 inches of gauze, over one area in front and one area on the back of the left chest for a total of fifteen hours. During the fall of 1914, the patient's improvement continued, and she was able to walk easily and resume her duties at home. Between Dec. 20, 1914, and December, 1915, the improvement continued steadily. There was not the slightest difficulty in walking, running, dancing or any physical exercise. The reflexes were still somewhat exaggerated. The patient's general condition was most excellent. The roentgenogram which was taken showed a moderate decrease in the area of the shadow. There was no further treatment given until March 26, 1916, when the treatment was

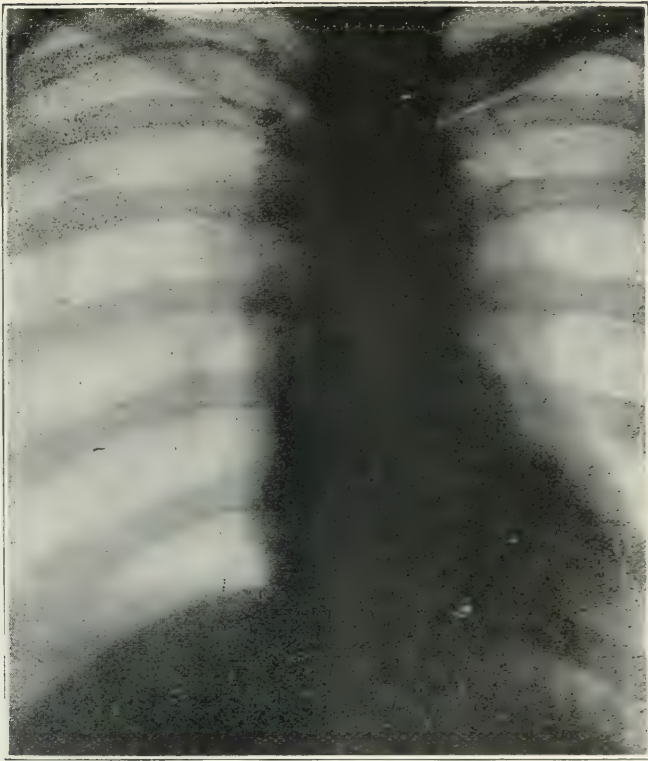


Fig. 9 (Case 4).—Marked reduction in the size of the tumor March 15, 1917 following the application of radium at intervals for about five months.

2.017 mg. of radium, screened with $1\frac{1}{2}$ inches of gauze and 3 mm. of lead over nine areas on the left side of the thorax for a total of two hours. The patient reported to me in May, 1917, still having good health, and with the breath sounds much clearer in the area in the left back, the fulness being only partial, and with Roentgen-ray findings as shown in Figure 4. She is in business, in which she has been actively engaged for more than one and one-half years.

CASE 3 (126).—*Sarcoma of the anterior mediastinum probably lymphosarcoma. Treated first with radium, July 9, 1913. In May, 1917, the patient was in excellent condition, and there was no evidence of growth.*

History.—Mrs. R. W. L., aged 30, was admitted to the hospital, July 9, 1913, complaining of swelling above the left clavicle, and pains in the neck and shoulders.

Examination.—The patient was medium-sized, slender and delicate looking. Special examination of the eyes, nose, throat and larynx revealed no trouble. No enlarged glands were found in the neck, axillae or groins. The heart sounds were clear. The pulse rate was 72 and equal on the two sides. There was no elevation of temperature. Immediately above the sternal end of the left clavicle could be felt a mass the size of a hen's egg, projecting up from the mediastinum. This was hard and fixed, and was continuous with an area of dullness behind the sternum. The

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Fig. 10 (Case 5).—Huge mediastinal mass which, on fluoroscopic examination, October 15, 1915, was seen to pulsate.

dullness extended 7 cm. to the right of the sternum and 5 cm. to the left. Fluoroscopic examination revealed no pulsation of the very extensive mass disclosed by the roentgenogram (Fig. 5). Under local anesthesia a small piece of tissue was removed from the mass in the neck. This proved on microscopic examination to be sarcoma. The classification was difficult, but we were inclined to believe that it was probably lymphosarcoma.

Treatment.—On July 9, 1913, the patient was radiated with 441 mg. of radium through 3 mm. of lead and $1\frac{1}{2}$ inches of gauze for twenty-two hours. The day after this radiation, July 10, 1913, a treatment was given with 400 mg. of radium through 3 mm. of lead and $1\frac{1}{2}$ inches of gauze over three areas of twelve hours. A few days after these treatments, all symptoms of pressure and pain had disappeared, the growth in the neck had diminished in size, and the mediastinal dullness had greatly subsided. Aug. 16, 1913, a radiation with 593 mg. of radium through 3 mm. of lead and 2 inches of gauze for thirty-two hours was carried out. Roentgenograms, Jan. 14, 1914, showed that the chest was clear. The same was true, Jan. 26, 1915. At that time, however, the patient was given a prophylactic radiation with 1,799 mg. of radium for a total of nine hours over five areas at 1 inch distance. An examination of the patient, March 15, 1916, revealed the same excellent condition in the mediastinum, there being no symptoms or disturbance of any kind.

Roentgenoscopy did not reveal any sign of tumor until the spring of 1917. Then, on the plate, a slight disturbance could be made out in the upper right mediastinum, and a small gland could be felt just above the clavicle on the right side. The patient returned, and in March, April and May had four radiations of the chest and neck. It is not certain that the gland felt above the clavicle was a return of the growth. It disappeared after the first radiation. At the present time, the patient shows a perfectly normal chest, and seems well in every way (Fig. 7).

CASE 4 (2270).—*Probable sarcoma of the mediastinum growth disappearing under radiation.*

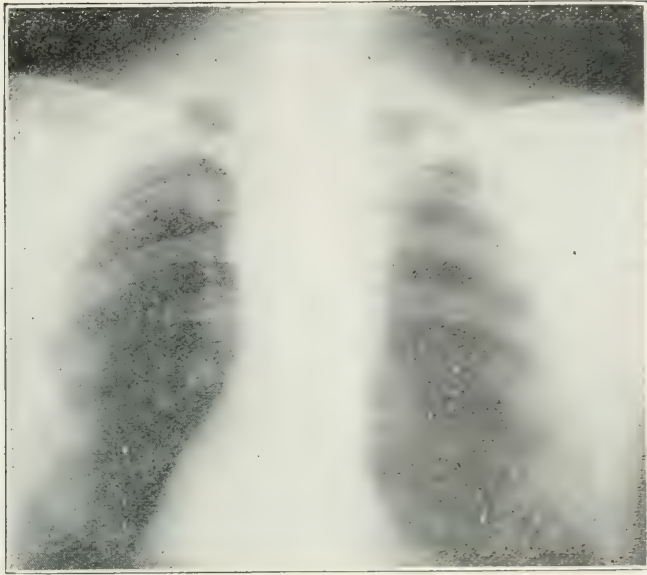


Fig. 11 (Case 5).—Slight thickening in the mediastinum, May 21, 1917; symptomatically the patient has no evidence of the disease.

History.—Miss N. C., aged 25, had hoarseness and discomfort in the chest with loss of weight, and was admitted to the hospital, Jan. 27, 1916.

Examination.—The patient was an extremely thin and delicate looking young woman. The eyes were slightly prominent, but showed no other abnormality. The nose, mouth and throat were negative except for a complete paralysis of the left vocal cord. The thyroid was slightly enlarged. One or two palpable glands were made out in the left cervical anterior chain, and one in the left axilla. These were just palpable and not hard. A slight diminution in respiratory movements was noted in the left side of the chest. The heart sounds were clear. There was a definite increase in the retrosternal dullness extending 7 cm. to the right of the sternum and 5 cm. to the left. This dullness rose and fell as the head was thrown back or lowered on the chest. Abdominal and pelvic examinations were entirely negative. The roentgenogram revealed an extensive tumor of the mediastinum apparently extending out into the lung tissue (Fig. 8).

Treatment.—The first treatment was given, Jan. 27, 1916, with 2,495 mg. of radium, screened with 3mm. of lead and 4 inches of gauze, applied to one area on the back and one area on the chest for seven hours each. Following this treatment the patient was greatly nauseated and upset for four or five days, and lost from 2 to 3 pounds in weight. She then, however, began to gain weight and improved markedly in general appearance. There was also a gradual subsidence of the percussible area of dullness and marked reduction in the shadow.

March 24, 1916, the entire chest, front and back, was radiated over eight portals with 2,558 mg. of radium through 3mm. of lead and $\frac{3}{4}$ inch of gauze for two hours on each portal. The same general malaise and disturbance were noted after this radiation as after the first. The patient then began improving again in weight and appetite. The final

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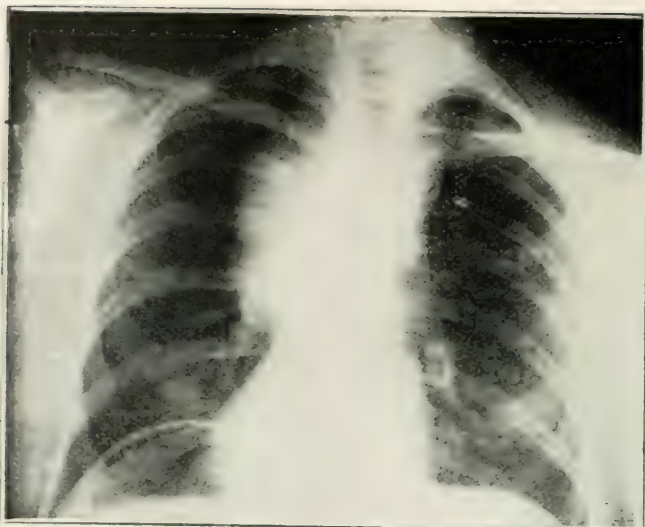


Fig. 12. (Case 6).—Immense shadow showing a large growth, May 15, 1916, in the mediastinum.

treatment was given, May 15, 1916, with 1,909 mg. of radium screened with 3mm. of lead and 3 inches of gauze on the front of the chest for four hours, and on the back of the chest for four hours.

The condition at the last roentgenographic examination made at the hospital in May is shown in Figure 9. The vocal cord paralysis had entirely disappeared. The patient then returned West, and is now in the Philippine Islands. She still is reported to be quite thin, but has no cough. A roentgenogram of the chest shows, if anything, a slight improvement in the condition over that of the last examination.

CASE 5 (1905).—Extensive mediastinal tumor with marked respiratory distress, greatly improved by treatment.

History.—G. J. S., man, aged 49, had a sensation of pressure in the chest with inability to breathe without great difficulty and severe cough.

Examination.—The patient was very well nourished in spite of the fact that he had lost 20 pounds in weight. His chest was broad and muscular; there was marked distention of the veins in the neck and a bluish cast to the countenance. A frequently repeated harsh cough distressed him. He was able to sleep only in the sitting posture.

Treatment.—The first treatment was given October 11, 1915, with 1,856 mg. of radium through 3 mm. of lead and 2 inches of gauze over five areas for a total of twelve hours. October 13, 1915, a second treatment of 1,744 mg. of radium was given through 3 mm. of lead and 2½ inches of gauze over six areas for two hours each, totaling twelve hours. October 16, 1915, a third treatment of 1,918 mg. of radium through 2 inches of gauze and 3 mm. of lead was given on four areas on the back for one and one-half hours each, totaling five hours. Following the second treatment, there was a tremendous improvement in the patient symptomatically. His cough subsided and he was able to sleep lying flat, for the first time in some weeks. There was not the slightest nausea or discomfort following the treatment. The difficulty in swallowing entirely disappeared. October 18, 1915, seven days after the treatments:

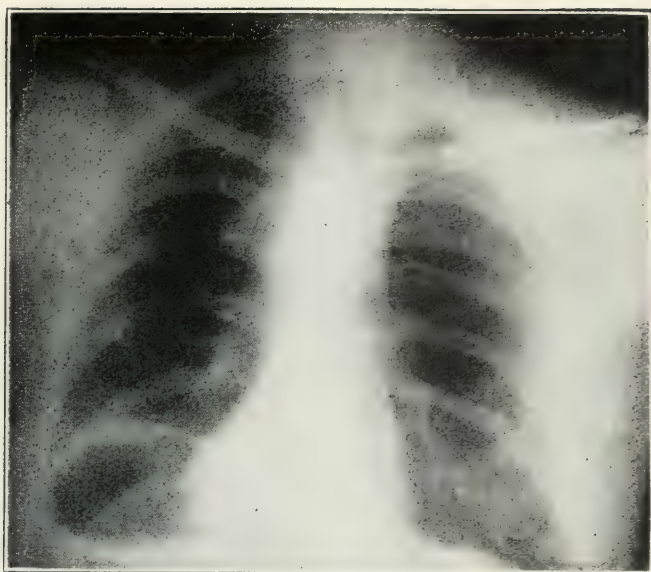


Fig. 14 (Case 6).—Marked shrinkage of the tumor, Jan. 24, 1917, following the institution of radium treatment.

were instituted, there was a marked reduction in the size of the mediastinal shadow as shown on roentgenographic examination. The patient returned February 7, 1916, and received radiation with 2,465 mg. of radium through 3 mm. of lead and 4 inches of gauze on two areas, each six and one-half hours. At that time, he was feeling very well indeed. The patient has continued to feel comfortable and well, and has been working at his business. He returned to the hospital May 21, 1917, and roentgenoscopy revealed the mass in the chest to be as shown in Figure 11. He was given, May 21, at a distance of 4 inches, a radiation for thirteen and one-half hours, with 1,115 mg. of radium. He is to return shortly for a repetition of this treatment. Except for a slight thickening in the roentgenogram (Fig. 11), and a slight increase in retrosternal dulness, the patient shows no evidence of disease. We, however, propose to carry on the treatments to a complete resolution if possible.

CASE 6 (2511).—*Huge mixed sarcoma of the mediastinum. Apparent cure.*

History.—J. H. L., man, aged 36, was admitted to the hospital May 15, 1916, complaining of a lump in the chest.

Examination.—The patient was strong and healthy-looking. He was hoarse, but had no difficulty in respiration or in deglutition. An examination of the eyes, nose, throat, larynx and pharynx revealed nothing abnormal. Several small, soft palpable glands were felt in the right and left sides of the neck, especially over the sternal end of the clavicle. No axillary glands were palpable. The inguinal glands were small. There were no abdominal masses, and no tenderness of the abdomen. Rectal examination showed normal pelvic organs. Lying just below the sternal ing tumor which measured 3 inches across the base and about $\frac{1}{2}$ inch end of the clavicle and bulging out of the front chest wall was a project-



Fig. 17 (Case 7).—Very large mediastinal tumor, April 7, 1916.

ing tumor which measured 3 inches across the base and about $\frac{1}{2}$ inch high.

Treatment—The first treatment was given May 15, 1916, with 2,905 mg. of radium through a filter of 1 inch of gauze and 3 mm. of lead on two areas of the neck for one hour each, and two areas of the chest for three and one-fourth hours through 2 inches of gauze and 3 mm. of lead, making a total of eight and one-half hours. May 23, 1916, through 3 inches of gauze and 3 mm. of lead, one area of the chest was radiated for three and three-fourths hours. June 5, 1916, 3,049 mg. of radium were applied screened with 3 mm. of lead and 2 inches of gauze on two areas of the back, three and three-fourths hours each. July 15, 1916, 2,938 mg. of radium screened with 3 mm. of lead and $1\frac{1}{4}$ inches of gauze were applied over two areas on the neck, two areas on the chest, and on two areas on the back to each axilla and to each groin, for one hour. Sept. 18, 1916, 928 mg. of radium were applied through 3 mm. of lead and $1\frac{1}{4}$ inches of gauze to three areas on the neck for three-fourths hour each; and 3,118 mg. of radium through 3 mm. of lead and $1\frac{1}{4}$ inches of gauze were applied on two areas of the neck, each axilla and each groin for three-fourths of an hour each. Nov. 18, 1916, 2,715 mg. of radium were applied through 3 mm. of lead and 4 inches gauze on one area for eleven hours.

This patient invariably had some nausea and some vomiting for a day or two after each radiation. However, from the beginning the symptoms steadily improved and have continued to improve up to the present time. The patient now has no cough, no expectoration, no visible tumor on inspection of the chest, and no palpable lymph glands. **A**

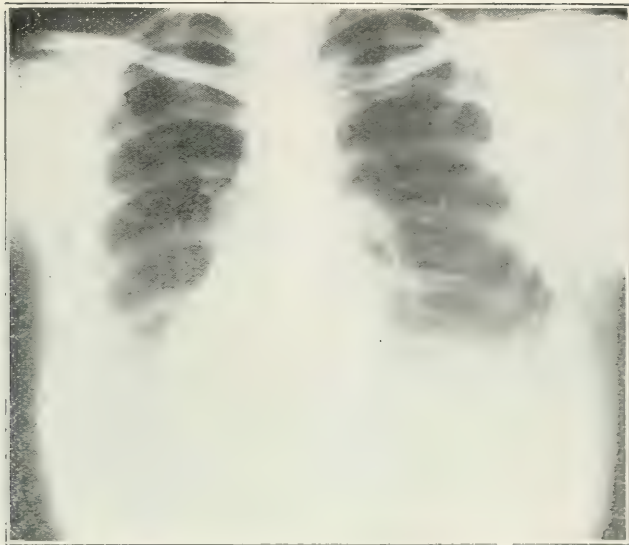


Fig. 17 (Case 7).—Roentgenogram made March 2, 1917, about one year after radium treatment was begun. Practically the entire disappearance of the tumor has occurred.

roentgenogram of the chest obtained May 10, 1917, is shown in Figure 14. The last treatment was given May 10, 1917, with 1,034 mg. of radium through 3 mm. of lead and 3 inches of gauze, six hours over the front of the chest and six hours over the back of the chest.

While it is yet too early to be dogmatic, it seems reasonable to assume that we shall secure a permanent cure in this case.

CASE 7 (2471).—An infection, probably Hodgkin's disease, associated with enormous enlargement of the mediastinal glands and liver. Patient apparently well thirteen months after radium treatment was instituted.

History.—Miss R. F., aged 18, had chills, fever, cough and pain in the back and legs and was admitted to the hospital April 6, 1916.

Microscopic Diagnosis.—A cervical lymph gland which was removed for examination showed Hodgkin's disease.

Examination.—At the time of admission to the hospital, April 6, 1916, the patient presented a picture of grave illness. She was very much emaciated and toxic; the temperature was 102 F.; the pulse rate 130. There was slight clubbing of the finger nails, the skin was lemon color. A number of enlarged lymph glands were palpated in the neck on both the right and left sides. The axillary glands were also palpable; the epitrochlear glands were not enlarged; the inguinal lymph glands were just palpable. Examination of the eyes, mouth, nose and throat disclosed no abnormality. A marked pulsation of the heart and vessels in the neck was noted. The heart was normal except there was a harsh rasping first sound. The retrosternal dulness was markedly increased both to the right and to the left, and a large hard mass was palpated in the left lobe of the liver. The abdomen exhibited no other mass or abnormality. The roentgenogram of the chest obtained April 7, 1916, showed a huge mediastinal tumor (Fig. 16).

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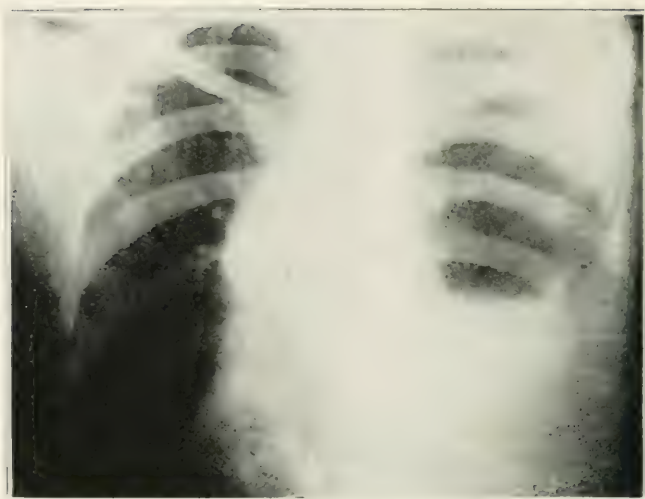


Fig. 18 (Case 8).—Deep-seated mediastinal tumor which caused difficulty in deglutition, November 27, 1914.

Treatment Beginning April 7, 1916, 2,543 mg. of radium, screened with $\frac{1}{4}$ inch of gauze and 3 mm. of lead, was applied for three-fourths hour to each of sixteen areas over the front and back of chest. The patient was not markedly upset by the treatment, and in four or five days began to take nourishment in a way she had not taken it for several months. Ten days after this treatment, both the pulse and the temperature had returned to normal, and up to the present time, there has not been any fever or rapid pulse rate. Roentgenograms made at frequent intervals demonstrated that the tumor mass in the chest was rapidly decreasing in size, and palpation showed the return of the liver to normal size in less than three weeks. The second treatment was given April 21, 1916, with 2,148 mg. of radium screened with 3 mm. of lead and 1 inch of gauze on six areas one hour each, totaling six hours. April 28, 1916, the third treatment was given with 1,702 mg. of radium filtered with 3 mm. of lead and $1\frac{1}{2}$ inches of gauze to six areas, one hour each, totaling six hours. May 28, 1916, the patient had a treatment with 2,561 mg. of radium screened with 3 mm. of lead and $1\frac{1}{4}$ inches of gauze applied to six areas on the neck and chest and two areas on the epigastrium, one hour each, making a total of eight hours.

During a month's stay in the hospital, the patient was completely transformed physically, her color became rosy, she gained in weight, the glands disappeared from the neck and axillae, and the tumor from the chest.

This patient has been under observation from time to time since she left the hospital. At present, she shows no evidence of the growth. In February, 1916, one or two small glands appeared in the left side of the neck, but disappeared spontaneously. Blood examination in January, 1917, revealed: red blood cells, 4,670,000; white blood cells, 10,000; hemoglobin, 83 per cent.; polymorphonuclear neutrophils, 74 per cent.; polymorphonuclear eosinophils, 1 per cent.; polymorphonuclear basophils, 0; small lymphocytes, 12 per cent.; large lymphocytes, 5 per cent.; transitionals, 8 per cent.

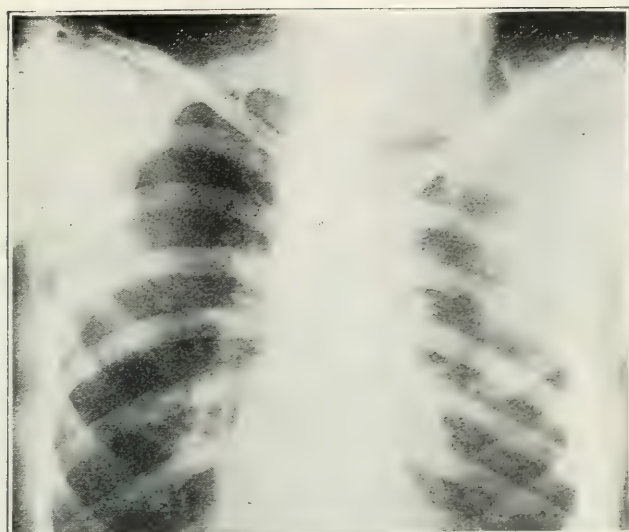


Fig. 19 (Case 8).—Almost complete disappearance of tumor November 8, 1915, as a result of about six months' radium treatment; complete recovery of patient.

A roentgenogram of the chest obtained March 7, 1918, shows the condition as in Figure 17. The patient seems in robust health.

CASE 8 (1284).—*Mediastinal sarcoma, possibly Hodykin's disease.* Patient was first treated Sept. 1, 1914, and is now entirely well.

History.—G. W. T., man, aged 45, had noticed difficulty in breathing and swallowing, and swelling of the face and hands. On admittance to the hospital, Sept. 1, 1914, no history was obtained of any member of the family having had tumor, tuberculosis or syphilis; in fact, the patient has enjoyed exceptional vigorous health.

Examination.(13)—The patient was very well nourished. He sat propped up in bed, breathing with a little difficulty, and the face and neck were slightly edematous and quite cyanotic. The right arm was somewhat swollen. The chest was covered with dilated venules and there were large dilated veins in the right neck. The eyes were normal. The nose, pharynx and mouth showed no abnormality except very bad teeth. The vocal cords were normal. The patient had a brassy cough. A bronchoscopic examination made by Dr. Samuel Crowe revealed the posterior wall of the trachea pushed forward at a point 15 cm. above the bifurcation. There was no enlargement of any of the lymph glands of the neck, axillae or groins. The abdominal examination failed to disclose any abnormality. The pulse was equal at the two wrists. The heart beat was regular; there was a marked systolic murmur at the apex. There was a marked extension of retrosternal dullness, particularly to the right side, and in the left pleural cavity, there was complete dullness due to fluid. Between the time of admission to the hospital, September 1, and the date on which I first saw him, Nov. 26, 1914, the patient had had the chest tapped, several Roentgen-ray treatments and rest in bed. However, his

13. For the details of the physical examination, I am indebted to the records of the Johns Hopkins Hospital, the patient having been examined by many members of the medical staff, and the Roentgen-ray and laryngological staffs.

RADIUM

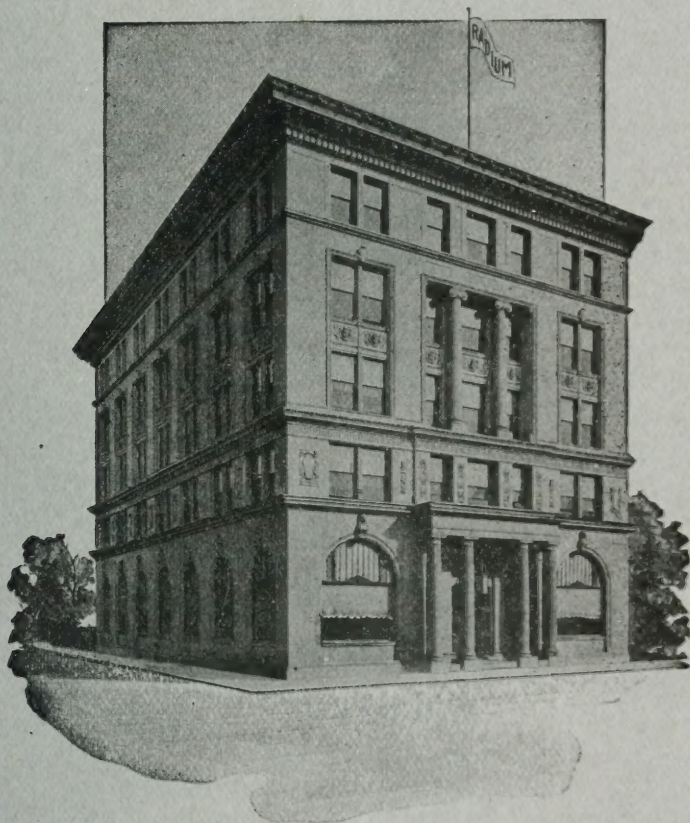
condition had remained very much the same (Roentgenogram of the chest is shown in Figure 18).

Treatment—He was treated Nov. 20, 1914, with 1,911 mg. of radium through 3 mm. of lead and $2\frac{1}{2}$ inches of gauze over six areas on the front and back of the chest, each treatment being for three hours. Following this treatment, there was a very marked improvement in the subjective symptoms, cough almost disappeared, and the patient was easily able to sleep flat on his back. Prior to this radiation and subsequent to the treatment, a great number of total and differential blood counts were made. Both the Wassermann and the tuberculin reactions were negative. A typical blood count was as follows: red blood cells, 5,120,000; white blood cells, 5,280; hemoglobin, 90 per cent.; polymorphonuclear neutrophils, 77 per cent.; eosinophils, 2 per cent.; basophils, 0; small mononuclears, 15 per cent.; large mononuclears, 5 per cent.; transitional cells, 1 per cent., and many blood platelets. One of the slides was submitted to Bunting of Wisconsin, who decided that the blood corresponded to Hodgkin's disease. The right pleural cavity reaccumulated fluid and was tapped again, Dec. 31, 1914. Feb. 18, 1915, there was still fluid at the base of the right lung, but small in quantity. Feb. 19, 1915, the second treatment with 1,799 mg. of radium through 3 mm. of lead and 2 inches of gauze was given over four areas for a total of ten hours. After this treatment, the patient went home and reported by letter that he was improved. The patient returned May 20, 1915, and was treated with 1,619 mg. of radium through 3 mm. of lead and $\frac{3}{4}$ inch of gauze over six areas on the chest, one hour on each area. July 19, 1915, he was treated with 2,214 mg. of radium screened with 3 mm. of lead and 1 inch of gauze over six areas of the chest and back for one hour each. Nov. 8, 1915, he was treated with 2,148 mg. of radium through 3 mm. of lead and 2 inches of gauze through four portals for a total of ten hours. April 18, 1916, the patient was treated with 2,669 mg. of radium, screened with 3 mm. of lead and 1 inch of gauze over ten areas for one-half hour each. Nov. 2, 1916, he was treated with 451 mg. of radium through 3 mm. of lead and 2 inches of gauze through four areas, three hours each. April 22, 1917, the patient received treatment with 997 mg. of radium through 3 mm. of lead and 3 inches of gauze, six hours on each of two areas. After May, 1915, the patient ceased to have any symptoms of the disease. The roentgenogram, obtained Oct. 31, 1916, showed no evidence of hydrothorax. At the present time, he is apparently in perfect health, able to work and to walk. He takes exercise equal in vigor to that taken by most of the farmers of his locality. He has no cough and no tumor, as shown by the roentgenogram (Fig. 19). In this case it would seem that we are quite justified in believing that a permanent cure has been obtained.

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